

AMENDMENTS TO THE CLAIMS

Upon entry of the present amendment, the status of the claims will be as is shown below.

This listing of claims will replace all prior versions and listings of claims in the application.

LISTING OF THE CLAIMS

1-21. (Cancelled)

22. (New) A network control framework apparatus for controlling resources at an intermediate network element connecting at least two communications networks, comprising:

    a gateway providing gateway functionality;

    a rule engine that performs a network resource control decision based on at least one specified rule, the at least one specified rule being specified according to a rule specification format;

    at least one special package added to the rule engine that provides a specialized functionality to the rule engine;

    a rule injector that injects or removes the at least one specified rule to or from the rule engine; and

    a distributor that distributes the at least one specified rule to the intermediate network element, comprising:

        a distributor that distributes indications that indicate whether at least part of the at least one specified rule is to be distributed;

        a distributor that distributes a signature embedded in a data packet to announce capabilities of the intermediate network element that the data packet traversed;

        a parser that parses the at least one specified rule to determine whether at least part of the at least one specified rule is distributed;

        an identifier that identifies a target network element to distribute at least part

- of the at least one specified rule;
- a distributor that distributes signaling data embedded in the data packet that informs the target network element to distribute at least part of the at least one specified rule; and
- a retriever that retrieves at least part of the at least one specified rule distributed to the target network element from the intermediate network element that distributes at least part of the at least one specified rule.
23. (New) The network control framework apparatus as recited in claim 22, wherein a format of the indications for the at least one specified rule for distribution comprises:
- a specification of a direction of distribution by specifying an endpoint of the direction;
- a specification of a number of intermediate network elements between a starting point and the endpoint; and
- at least one of a specification of the number of intermediate network elements from the endpoint, and specific content distributed at the intermediate network elements.
24. (New) The network control framework apparatus as recited in claim 22, wherein a format of the signature embedded in the data packet comprises:
- an identification of the intermediate network element specified by the signature;
- the at least one special package that is installed on the one intermediate network element specified by the signature; and
- an indication that specifies a capability of accepting or generating at least part of the at least one specified rule for distribution.
25. (New) The network control framework apparatus as recited in claim 22, wherein the signature of the intermediate network element that the data packet traversed are stored with a

starting point and an endpoint that the data packet traversed corresponding to a traversal order for the data packet and a transmission protocol to which the data packet belongs.

26. (New) The network control framework apparatus as recited in claim 22, wherein a format of the signature embedded in the data packet comprises:

an identification of the intermediate network element; and

an identification of the at least one special package installed on the intermediate network element.

27. (New) The network control framework apparatus as recited in claim 22, wherein a format of the signature embedded in the data packet comprises:

an identification of an endpoint that the data packet flows to;

an identification of a starting point that the data packet flows from;

a transmission protocol to which the data packet belongs;

a signature array of intermediate network elements in an order corresponding to a traversal order of the data packet, from one intermediate network element where the format of the signature embedded in the data packet is stored, to the endpoint; and

a number of signatures of the intermediate network elements in the order corresponding to the traversal order of the data packet from the one intermediate network element where the format of the signature embedded in the data packet is stored to the endpoint.

28. (New) The network control framework apparatus as recited in claim 22, further comprising:

a signaler that signals the intermediate network element to express a desire to distribute a collection of specified rules to the intermediate network element, comprising:

an identification of an intermediate network element to which the collection of specified rules is distributed;

an identification of an intermediate network element from which the collection of specified rules is distributed; and

an identification of the collection of specified rules.

29. (New) The network control framework apparatus as recited in claim 22, further comprising:

a retriever that retrieves a collection of specified rules, from the intermediate network element that distributes the collection of specified rules, by the intermediate network element to which the collection of specified rules is distributed, comprising:

a channel establisher that establishes a communication channel between the intermediate network element where the collection of specified rules is distributed to and the intermediate network element where the collection of specified rules is distributed from;

an identification provider that provides an identification of the collection of specified rules that is distributed via the communication channel by the intermediate network element to which the collection of specified rules is distributed; and

a transmitter that transmits the collection of specified rules that is distributed via the communication channel by the intermediate network element from which the collection of specified rules is distributed.

30. (New) The network control framework apparatus as recited in claim 22, wherein the at least two communications networks comprise a client node that sends a request to a server node via the intermediate network element,

wherein the server node accepts the request with a response,

wherein the at least two communications networks further comprise a channel establisher that establishes a communications channel between the server node and the client node through the intermediate network element,

wherein the server node transmits data packets through the communications channel to the client node until the client node sends a request, via the intermediate network element, to teardown the communications channel, and

wherein the client node transmits information related to transmission statistics to the server node.

31. (New) The network control framework apparatus as recited in claim 30, further comprising:

an author provider that provides an author of the at least one specified rule to trigger least one specified rule at the intermediate network element based on a control method, the control method comprising:

a rule to be evaluated when the intermediate network element receives the request from the client node destined for the server node;

a rule to be evaluated when the intermediate network element receives the response from the server node destined for the client node;

a rule to be evaluated when the intermediate network element receives a data packet containing a content sent by the server node to the client node through the communications channel established between the server node and the client node;

a rule to be evaluated when the intermediate network element receives a data packet containing the information related to transmission statistics from the client node to the server node;

a rule to be evaluated when the intermediate network element receives a specified number of data packets containing the content sent by the server node to the client node through the communications channel established between the server node and the client node; and

a rule to be evaluated when the intermediate network element receives a data packet containing the content sent by the server node to the client node through the communications channel established between the server node and the client node after a lapse of a specified timer value measured by a recurrent timer.

32. (New) The network control framework apparatus as recited in claim 22, further comprising:

    a controller that uses a set of parameters in the at least specified rule to control a content or a content delivery session to achieve device independence in delivering the content, comprising:

        a set of user preference parameters comprising preferences of a human user that consumes the content;

        a set of agent capabilities parameters comprising capabilities of a software agent employed by the human user to retrieve the content;

        a set of device capabilities parameters comprising capabilities of hardware employed by the human user to retrieve the content; and

        a set of natural environment parameters comprising information about an environment in which the human user retrieves the content.

33. (New) The network control framework apparatus as recited in claim 32, wherein the set of user preference parameters comprises:

    a preference for the human user that relates to a method of retrieving the content;

    a preference for the human user that relates to a language used in the retrieved content;

    a preference for the human user that relates to presenting the retrieved content;

    an age group of the human user that retrieves the content;

    a gender of the human user that retrieves the content; and

    an employment status of the human user that retrieves the content.

34. (New) The network control framework apparatus as recited in claim 32, wherein the set of agent capabilities parameters comprises:

    a type of the software agent employed by the human user to retrieve the content;

a content format supported by the software agent employed by the human user to retrieve the content;

a content language supported by the software agent employed by the human user to retrieve the at least one content; and

a transmission protocol supported by the software agent employed by the human user to retrieve the at least one content.

35. (New) The network control framework apparatus as recited in claim 32, wherein the set of device capabilities parameters comprises:

a type of the hardware employed by the human user to retrieve the content;

a processor speed and processor family of the hardware employed by the human user to retrieve the content;

a memory capacity of a physical storage and a secondary storage of the hardware employed by the human user to retrieve the content;

a display depth and a resolution of the hardware employed by the human user to retrieve the content; and

an operating system that runs on the hardware employed by the human user to retrieve the content.

36. (New) The network control framework apparatus as recited in claim 32, wherein the set of natural environment parameters comprises:

information related to a location where the human user is retrieving the at least one content;

information related to a mobility of the human user that retrieves the content; and

information related to a lighting condition in which the human user is retrieving the content.

37. (New) The network control framework apparatus as recited in claim 32, wherein the at least one special package is capable of interpreting and evaluating the at least one specified rule.

38. (New) A network control framework method for controlling resources at an intermediate network element connecting at least two communications networks, comprising:

providing a gateway functionality by a gateway;

performing a network resource control decision by a rule engine based on at least one specified rule, wherein the at least specified rule is specified according to a rule specification format;

offering a specialized functionality to the rule engine by at least one special package added to the rule engine;

injecting or removing the at least one specified rule to or from the rule engine by a rule injector; and

distributing the at least one specified rule to the intermediate network element by:

distributing indications in the at least one specified rule to indicate whether at least part of the at least one specified rule is to be distributed;

distributing a signature embedded into a data packet to announce a capability of the intermediate network element that the data packet

traversed;

parsing the at least one specified rule to determine whether at least part of the at least one specified rule is distributed;

identifying a target network element to distribute at least part the at least one specified rule;

distributing a signal embedded into the data packet to inform the target network element to distribute at least part of the at least one specified rule; and

retrieving at least part of the at least one specified rule distributed to the target network element from the intermediate network element that distributes the at least part of the at least one specified rule.

39. (New) The network control framework method as recited in claim 38, further comprising:

extracting the signature embedded in the data packet, by:

    checking for the signature embedded in the data packet;

    checking for a signature formatted according to a predetermined data format that is previously stored and has a matching starting point, an endpoint and a transmission protocol;

    allocating a new data format when there is no predetermined data format that is previously stored specifying the starting point, the endpoint and the transmission protocol;

    purging data stored in the predetermined data format having the matching starting point, the endpoint and the transmission protocol;

    preparing a last-in-first-out data structure;

    extracting the signature embedded in the data packet and pushing the signature onto the last-in-first-out data structure;

    removing each element in the last-in-first-out data structure and recording each element in the predetermined data format; and

    recording a number of signatures extracted, in the predetermined data format.

40. (New) The network control framework method as recited in claim 38, further comprising:

    parsing the at least one specified rule to determine whether at least part of the at least one specified rule is to be distributed, by:

        checking the at least one specified rule for syntactical validity;

        rejecting the at least one specified rule when a syntactical error exists;

        checking the at least one specified rule for a distribution indication;

- evaluating the at least one specified rule locally when no distribution indication exists;
- determining a remote intermediate network element to distribute the at least one specified rule to;
- locally evaluating the at least one specified rule when no remote intermediate network element is determined to exist;
- checking whether the remote intermediate network element contains a special package required by the at least one specified rule;
- locally evaluating the at least one specified rule when the remote intermediate network element does not have the special package required by the at least one specified rule; and
- distributing the at least one specified rule to the remote intermediate network element.

41. (New) The network control framework method as recited in claim 38, further comprising:
- determining a remote intermediate network element that the at least one specified rule is to be distributed to given a predetermined distribution indication, by:
    - locating a signature in a predetermined data format with a matching starting point, endpoint and transmission protocol;
    - determining that no remote intermediate network element exists when no predetermined data format is located;
    - setting a temporary variable as a specified number of intermediate network elements between a specified endpoint in the predetermined distribution indication;
    - setting the temporary variable to a value of the specified number of intermediate network elements in the predetermined data format when a specified number of intermediate network elements towards or from the endpoint in the predetermined distribution indication is

greater than a number of intermediate network elements towards or from the specified ending point in the distribution indication,

wherein the predetermined distribution indication comprises a specification of the endpoint and a specification of the number of intermediate network elements to the endpoint, set the temporary variable to a value equal to the number of intermediate network elements given in the predetermined data format minus an original value of the temporary variable,

wherein the distribution indication comprises a specification of the endpoint and the specification of the number of intermediate network elements from the endpoint, and sets the temporary variable to a value equal to the original value in the temporary variable less by one;

declaring the remote intermediate network element to be the network element specified in a signature stored in the predetermined data format in which the signature has an index in an array of signatures in the predetermined data format equal to the value stored in the temporary variable; and

declaring that no remote intermediate network element exists when an index equal to the value stored in the temporary variable in the array of signatures in the predetermined data format does not exist.

42. (New) A communications network comprising the network control framework apparatus recited in claim 22 that controls resources at the intermediate network element connecting the at least two communications networks.